

REMARKS

In accordance with the foregoing, the claims 1, 2 and 5 have been amended. Claims 10 and 11 have been added. Support for the amendments to claims 1 and 2 may be found, inter alia in claim 5 as filed originally. Support for new claims 10 and 11 may be found in claims 1 and 2, respectively, as they were filed originally. Claims 1-11 are pending and under consideration.

Priority:

The Applicants acknowledge with appreciation the acknowledgement of their claim for priority under 35 U.S.C. § 119 and receipt of the priority documents.

Claim Rejections - 35 U.S.C. § 103:

Claims 1, 2, 3, 6 and 9 were rejected under 35 U.S.C. §103(a) as being unpatentable over Bovensiepen et al., US 6,222,740 (hereinafter "Bovensiepen ") in view of Echigo et al., US 6,274,821 (hereinafter "Echigo"). The rejection is traversed to the extent it might apply to the claims as they have been amended. Reconsideration is earnestly solicited.

Amended claim 1 now sets forth a multilayer wiring board which comprises: a core portion including a core insulating layer containing a carbon fiber material; a first lamination wiring portion bonded to the core portion and having a laminated structure including at least a first insulating layer and a first wiring pattern, the first insulating layer containing glass cloth; and a second lamination wiring portion bonded to the first lamination wiring portion and having a laminated structure including at least a second insulating layer and a second wiring pattern.

The core portion, the first lamination wiring portion and the second lamination wiring portion are arranged in a stack. The core insulating layer, the first insulating layer and the second insulating layer have respective thermal expansion coefficients defined in a surface-spreading direction transverse to a stacking direction of these three layers. The thermal expansion coefficient of the core insulating layer is smallest among said three layers, whereas the thermal expansion coefficient of the second insulating layer is largest among said three layers. The thermal expansion coefficient of the first insulating layer is larger than that of the core layer but smaller than that of the second insulating layer.

According to the present invention as defined above, the thermal expansion coefficient of

the core insulating layer is smallest among the three layers (the core layer, the first insulating layer and the second insulating layer) as the result of the fact that the core insulating layer contains carbon fiber material which is extremely small in thermal expansion coefficient, whereas the thermal expansion coefficient of the second insulating layer is largest among the three layers due to the fact that the second insulating layer contains no reinforcing fiber material.

The absence of reinforcing fibers makes the second insulating layer capable of forming a micro wiring pattern at very high density. However, too large a difference (or abrupt change) in thermal expansion coefficient between the core insulating layer and the second insulating layer is disadvantageous for stability of the laminate structure. The present invention proposes to solve this problem by interposing the first insulating layer, which has an intermediate thermal expansion coefficient, as a buffer layer between the core layer and the second insulating layer. Further, the first insulating layer provides another advantage of providing an additional wiring pattern.

Neither Bovensiepen nor Echigo teach or suggest that a first insulating layer having an intermediate thermal expansion coefficient should be interposed between a core insulating layer having a smaller thermal expansion coefficient and a second insulating layer having a larger thermal expansion coefficient, as recited in claim 1. Thus, even if Bovensiepen were combined with Echigo as proposed in the Office Action, the claimed invention would not result.

Furthermore, claim 1 recites:

"a first lamination wiring portion bonded to the core portion and having a laminated structure including at least a first insulating layer and a first wiring pattern, the first insulating layer containing glass cloth."

Bovensiepen discloses a carbon-fiber-reinforced core 5 but fails to disclose whether or not the insulating layers 20-25 made of epoxy resin is reinforced by a glass cloth, as noted in the Office Action at page 3. The Office Action seeks to compensate for this deficiency of Bovensiepen by combining it with Echigo. Echigo, however, merely discloses the use of a glass-epoxy substrate. It is not even clear whether such a substrate should form a core layer or a buildup layer formed on the core layer.

Furthermore, the passage in Echigo cited at page 3 of the Office Action in support of this combination:

"Conventionally, a printed circuit board for mounting electronic parts is composed of a glass-epoxy substrate including laminated sheets, each of which is made of a glass cloth impregnated with epoxy-prepreg. This kind of circuit board has been

generally used with high reliability for mounting parts.”

appears at column 1, lines 19-24 of Echigo, in the section entitled “Background of the Invention.” This passage thus represents Echigo’s rationale for *deviating* from the related art, rather than any positive teaching to use glass cloth, contrary to the implication in the Office Action. The need to use a glass-epoxy substrate including laminated sheets made of a glass cloth impregnated with epoxy-prepreg in the construction of printed circuit boards is, according to Echigo, one of the *problems* with the related art. It is submitted, therefore, that persons of ordinary skill in the art at the time the invention was made who read this passage of Echigo would have been deterred, not encouraged, from combining Echigo with Bovensiepen as proposed by the Office Action.

Echigo, in fact, goes on to note at column 1, lines 31-38 that:

“In addition, in a device complying with the high mounting density requirement for a CSP (Chip Size Package), a MCM (Multi Chip Module), a flip chip, and the like, there is a tendency that the distances between electrodes of the board and mounted part bodies are decreased. This enhances adverse effects by thermal stress and mechanical stress which are produced around the electrodes of the board after the parts are mounted.”

Echigo thus warns against adverse effects caused by thermal stress and mechanical stress that are produced around the electrodes of the board after the parts are mounted. Glass is stiff, and has a low coefficient of thermal expansion, and thus would exacerbate the adverse effects caused by thermal stress and mechanical stress produced around the electrodes of the board after the parts are mounted, not relieve them. It is submitted, therefore, that persons of ordinary skill in the art who read Echigo for all it contained at the time the invention was made would have been deterred from combining Echigo with Bovensiepen as proposed by the Office Action.

Bovensiepen, similarly, teaches away from incorporating a material such as glass cloth, which is heavy, at column 1, lines 52-56 where he notes the disadvantages associated with extra weight:

“A further disadvantage is that the core substrates extending over the entire surface extent of the circuit board greatly increase the weight of the circuit board, which is extremely undesirable in space technology.”

It is submitted, therefore, that persons of ordinary skill in the art who read Bovensiepen for all it contained at the time the invention was made would have been deterred from combining Echigo with Bovensiepen as proposed by the Office Action.

In addition, the teachings of Bovensiepen and Echigo are diametrically opposed to one another. Bovensiepen, for example, touts the advantages of a core substrate made of a material having a high modulus of elasticity, such as molybdenum, at column 3, line 1, while Echigo suggests using a polymeric resin, which would have a low modulus of elasticity, at column 2, line 28.

Finally, the Office Action provides no motivation or suggestion to combine the teachings of Bovensiepen and Echigo as required by 35 U.S.C. § 103(a) and the M.P.E.P. § 706.02(j)(D), beyond citing In Re Leshin, 227 F. 2d 197, 125, 125 U.S.P.Q. 416 (CCPA 1960) for the proposition that “it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice” (Office Action at page 3).

In Leshin, however, an intended use had been identified. Here, in contrast, none of the cited references had identified any intended use for which glass cloth would have been suitable at the time the invention was made. Both Echigo and Bovensiepen, in fact, teach away from the use of glass cloth, as discussed more fully above. It is submitted, therefore, that the combination of Bovensiepen and Echigo proposed by the Office Action would not have been obvious to persons of ordinary skill in the art at the time the invention was made. Claim 1 is submitted to be allowable. Withdrawal of the rejection of claim 1 is earnestly solicited.

Claims 6 and 9 depend from claim 1 and add additional distinguishing elements. Claims 6 and 9 are thus also submitted to be allowable. Withdrawal of the rejection of claims 6 and 9 is earnestly solicited.

The rejection of claims 2 and 3:

Claim 2 recites,

“the first insulating layer containing glass cloth,”

and

“wherein the core insulating layer, the first insulating layer and the second insulating layer have respective thermal expansion coefficients defined in a surface-spreading direction transverse to a stacking direction of these three layers, the thermal expansion coefficient of the core insulating layer being smallest among said three layers, the thermal expansion coefficient of the second insulating layer being largest among said three layers, the thermal expansion coefficient of the first insulating layer being larger than that of the core layer but smaller than that

of the second insulating layer.”

Claim 2 has been amended similarly to amended claim 1, and also recites an insulating layer containing glass cloth. Neither Bovensiepen nor Echigo disclose the combination of a core insulating layer, a first insulating layer and a second insulating layer having respective thermal expansion coefficients defined in a surface-spreading direction transverse to a stacking direction of these three layers, the thermal expansion coefficient of the core insulating layer being smallest among said three layers, the thermal expansion coefficient of the second insulating layer being largest among said three layers, the thermal expansion coefficient of the first insulating layer being larger than that of the core layer but smaller than that of the second insulating layer, as discussed more fully above with respect to the rejection of claim 1.

Furthermore, the combination of Bovensiepen and Echigo proposed by the Office Action would not have been obvious to persons of ordinary skill in the art at the time the invention was made, as also discussed above with respect to the rejection of claim 1. Claim 2 ought thus to be allowable as well, for at least those reasons discussed above with respect to claim 1.

Claim 3 depends from claim 2 and adds additional distinguishing elements. Claim 3 is thus also submitted to be allowable. Withdrawal of the rejection of claim 3 is earnestly solicited.

The rejection of claims 5, 7, and 8:

Claims 5, 7, and 8 were rejected under 35 U.S.C. §103(a) as being unpatentable over Bovensiepen and Echigo, and further in view of Vasoya et al., US 2002/0157859 (hereinafter “Vasoya”), Yuhas et al., US 5,350,621 (hereinafter “Yuhas”), and Hoebener et al., US 5,825,629 (hereinafter “Hoebener”). The rejection is traversed to the extent it might apply to the claims as they have been amended. Reconsideration is earnestly solicited.

Claims 5, 7, and 8 depend from claim 1 and add additional distinguishing elements. Neither Bovensiepen nor Echigo disclose the combination of a core insulating layer, a first insulating layer and a second insulating layer having respective thermal expansion coefficients defined in a surface-spreading direction transverse to a stacking direction of these three layers, the thermal expansion coefficient of the core insulating layer being smallest among said three layers, the thermal expansion coefficient of the second insulating layer being largest among said three layers, the thermal expansion coefficient of the first insulating layer being larger than that of the core layer but smaller than that of the second insulating layer, as discussed more fully above with respect to the rejection of claim 1. Neither Vasoya nor Yuhas nor Hoebener do either, and thus cannot make up for the deficiencies of either Bovensiepen or Echigo with

respect to claim 1. Thus, even if Bovensiepen were combined with Echigo, Vasoya, Yuhas, and Hoebener as proposed in the Office Action, the claimed invention would not result.

Furthermore, no persons of ordinary skill in the art would have seen fit to combine Bovensiepen and Echigo at the time the invention was made, as also discussed more fully above with respect to the rejection of claim 1. Neither Vasoya nor Yuhas nor Hoebener are asserted to disclose a first insulating layer containing glass cloth as recited in claim 1 at all, and would thus not compensate for this deficiency of Bovensiepen even if they were combined with it as well. Claims 5, 7, and 8 are thus also submitted to be allowable. Withdrawal of the rejection of claims 5, 7, and 8 is earnestly solicited.

Double Patenting:

Claims 1-4, 6, 7, and 9 were rejected under the judicially created doctrine of obviousness-type double patenting as unpatentable over claims 1, 2, 6, 7, and 12 of Tani et al., US 6,869,665 (hereinafter "Tani") in view of Echigo and Alcoe et al., US 2002/0139578 (hereinafter "Alcoe"). The rejection is traversed to the extent it might apply to the claims as they have been amended. Reconsideration is earnestly solicited.

Amended claim 1 now sets forth a multilayer wiring board which comprises: a core portion including a core insulating layer containing a carbon fiber material; a first lamination wiring portion bonded to the core portion and having a laminated structure including at least a first insulating layer and a first wiring pattern, the first insulating layer containing glass cloth; and a second lamination wiring portion bonded to the first lamination wiring portion and having a laminated structure including at least a second insulating layer and a second wiring pattern.

Claims 1, 2, 6, 7, and 12 of Tani do not teach or suggest the claimed laminate structure wherein a first insulating layer having an intermediate thermal expansion coefficient is interposed between a core insulating layer having a smallest thermal expansion coefficient and a second insulating layer having a largest thermal expansion coefficient. Neither Echigo nor Alcoe do either, and thus cannot make up for the deficiencies of claims 1, 2, 6, 7, and 12 of Tani with respect to claim 1. Thus, even if claims 1, 2, 6, 7, and 12 of Tani were combined with Echigo and Alcoe as proposed in the Office Action, the claimed invention would not result.

Furthermore, claims 1, 2, 6, 7, and 12 of Tani do not disclose a first insulating layer containing glass cloth, as acknowledged graciously in the Office action at page 12. The Office action seeks to compensate for this deficiency of claims 1, 2, 6, 7, and 12 of Tani by combining them with Echigo. Echigo, however, teaches away from the use of glass cloth, as discussed

more fully above with respect to the rejection of claim 1 under 35 U.S.C. § 103(a). Furthermore, the Office Action provides no motivation or suggestion to combine the teachings of Echigo with any other reference, let alone claims 1, 2, 6, 7, and 12 of Tani, as also discussed more fully above with respect to the rejection of claim 1 under 35 U.S.C. § 103(a). Claim 1 is thus submitted to be allowable. Withdrawal of the rejection of claim 1 is earnestly solicited.

Claims 4, 6, 7, and 9 depend from claim 1 and add additional distinguishing elements. Claims 4, 6, 7, and 9 are thus also submitted to be allowable. Withdrawal of the rejection of claims 4, 6, 7, and 9 is earnestly solicited.

The rejection of claims 2 and 3:

Claim 2 has been amended similarly to amended claim 1, as discussed above, and also recites an insulating layer containing glass cloth. Claim 2 ought thus to be allowable as well, for at least those reasons discussed above with respect to claim 1.

Claim 3 depends from claim 2 and adds additional distinguishing elements. Claim 3 is thus also submitted to be allowable. Withdrawal of the rejection of claim 3 is earnestly solicited.

New claims 10 and 11:

New claims 10 and 11 are substantially claims 1 and 2 as filed originally. None of the cited references teach, disclose, or suggest a multilayer wiring board having a core portion including a core insulating layer containing a carbon fiber material, a first lamination wiring portion bonded to the core portion and having a laminated structure including at least a first insulating layer containing glass cloth and a first wiring pattern, and a second lamination wiring portion bonded to the first lamination wiring portion and having a laminated structure including at least a second insulating layer and a second wiring pattern, as discussed more fully above with respect to claims 1 and 2. Claims 10 and 11 are thus believed to be in condition for allowance as well.

Summary

It is submitted that the references cited by the Examiner, taken individually or in combination, do not reach or suggest the features of the present claimed invention. Thus, it is submitted that claims 1-11 are in a condition suitable for allowance. Entry of the Amendment, reconsideration of the claims and an early Notice of Allowance are earnestly solicited.

Serial No. 10/629,770

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

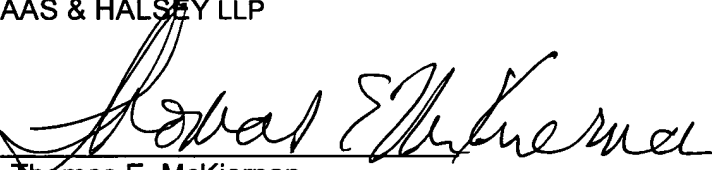
Respectfully submitted,

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